Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
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NVS

NATURAL VALLEY STORAGE:
a partnership with nature

spring 1976

U.S. Army Corps of Engineers New England Division 424 Trapelo Road Waltham, Massachusetts 02154

In 1965 the Congress directed the U.S. Army Corps of Engineers to undertake a study of the resources of the Charles River Watershed in eastern Massachusetts, with a particular emphasis on how to control flood damages in the urbanized lower watershed and head off any significant flood damages in the urbanizing middle and upper watershed. A 1968 interim recommendation led to the authorization for a new dam near the mouth of the river in Boston, a dam already under construction and scheduled for completion late in 1977. In 1972 the Corps issued its final report for the watershed which included a recommended new direction in flood damage prevention:

"The flood control management plan recommended by this Corps study calls for Federal acquisition and perpetual protection of 17 crucial natural valley storage areas totalling some 8,500 acres. The logic of the scheme is compelling. Nature has already provided the least-cost solution to future flooding in the form of extensive wetlands which moderate extreme highs and lows in stream flow. Rather than attempt to improve on this natural protection mechanism, it is both prudent and economical to leave the hydrologic regime established over the millenia undisturbed. In the opinion of the study team, construction of any of the most likely alternatives, a 55,000 acre-foot reservoir, or extensive walls and dikes, can add nothing."

The story of Natural Valley Storage is not a fairy tale. It is real. The Corps is proud of its program and wants to share news of its progress with watershed residents. This newsletter is the first of several by which the Corps expects to keep the public up to date on NVS.

Stop River winds through the Medfield Marshes before joining the Charles River

Few natural treasures no matter how highly regarded or how lately won will remain forever immune from the inroads of a growing society. Seemingly idle lands will continue to be the target of proposals for transportation corridors, public utility sites, and even intensive recreation. Policies will have to be developed to ward off these inroads by virtue of prior claim. One social need is difficult to weigh against another, but the NVS areas must be first and foremost and forever available for protecting the residents of the valley from themselves. An advisory committee will sit with the Corps when decisions on uses and non-uses of the NVS areas are made.

Wetlands are an integral part of the river system. Yesterday's security is in danger of becoming today's complacency. And today's complacency could spell tomorrow's heartache. Continuing encroachment on the river's own safety valves diminishes their ability to perform the same function for us. The Corps has calculated dollar losses as a function of loss of wetlands. Damages rise with flood levels as loss of storage forces flood waters to higher elevations. The Corps has calculated these risks as well. Unless we mend our ways, we are reminded, damage costs will continue to rise steadily. How much will NVS cost the local economy? A more crucial question is how much the loss of it will cost. For the next two years at least the Corps has its work cut out for it in the Charles River Watershed. Topping the priority list for acquisition are Areas G, H, K, and L; next Areas B through E and a look-again at Area A. Areas M, N, O, P, R, and S will follow, and finally Areas F, I, and J. They do not rank by size or sequence so much as by the Corps' understanding of their fragile standing in the watershed. An optimistic schedule indicates acquisition by spring of 1977. Then we have the rest of our lives to reap the benefit of this small but exciting investment. The face of the watershed may gradually alter, but its feet will remain dry.

Upstream — Natural Valley Storage

Downstream — Charles River Basin

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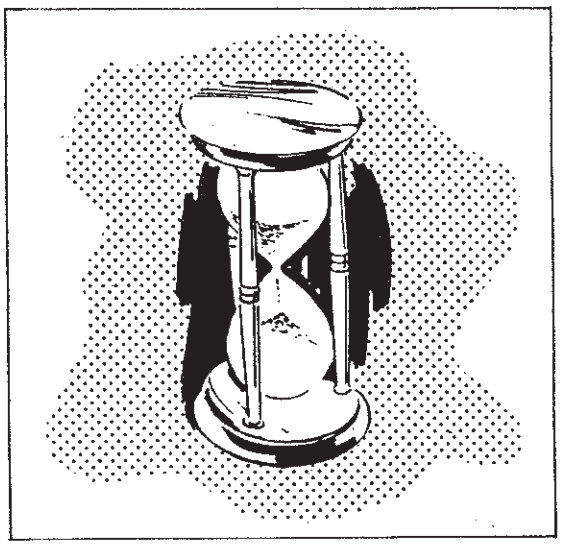


Compensation to municipalities is provided under MGL Chapter 58 section 17B, which authorizes the Commonwealth to make annual payments to cities and towns for lands taken for flood control purposes. The payment would be based on the tax rate at the time the land was acquired and on the average assessed valuation for five years prior to the taking.

It will be important to consider not only what it will cost to implement NVS but what it would cost not to. While they do go off the tax rolls, wetlands have credit. They do not, for example, create traffic jams, have fires, go to school, need police protection, trash collection, or plowing. They do sop up storm water. Wetlands provide habitat for the many small creatures that hunters, fishermen, and birders delight in. They represent open space buffers between developments. And they help insure that water will flow in the river in summer when the residents most often turn to it for the pleasures of boating and fishing. Our prime reward for NVS protection though is dry feet.

Partners are needed for the Federal presence in the Charles River Watershed. State and local cooperation is important, and the Corps has identified several specific areas of opportunity. The authorization includes as a requirement (not an option): "Local interests are required to prevent modification or alteration of existing roadways, utilities, bridges, culverts, and any other improvements that might affect the drainage characteristics of natural storage areas; adopt and enforce regulations to restrict development of flood plain lands; and operate and maintain the dams along the Charles River."

The Congressional authorization requires a commitment from the Commonwealth of Massachusetts that flood plain and wetlands protection zoning will be enforced in the watershed. To subscribe to the principles of the Natural Valley Storage program but allow the destruction of remaining wetlands and flood plains would be a contradiction in terms and a violation of the complete watershed flood management program. As outstanding as it is, the Natural Valley Storage program cannot perform the entire flood management act alone. Wetlands of varying sizes are scattered throughout the watershed, and each in its own dimension is a valuable part of the whole.

A strong admonition is directed at the Commonwealth and at those cities and towns lying within the increasingly-pressured Charles River Watershed. Local growth must be directed away from the remaining wetlands and flood plains. Local planning boards and zoning boards of appeal have responsibility in these areas and can make a commitment to the principles of natural flood protection by directing development to more suitable lands. While opportunities to uphold their end of the program are numerous at the local level, the Corps sighed realistically at the opportunities likely to be lost:" . . . . there is no reason to think that communities will recognize their individual contributions to the over-all flooding situation any more than they have in the past. Without external coordination, municipalities will pursue independent development plans, nibbling away at marsh storage areas piecemeal until the aggregate effect of their expansion is felt as a major flood disaster. By filling and paving over previously natural areas, they will have simultaneously increased storm runoff and decreased the ability of the land to accommodate it safely."

Massachusetts pioneered in wetlands legislation, which helped immeasurably in gaining public acceptance of the concept of NVS. Nevertheless, enforcement efforts have lagged behind legislative intent, and many watershed wetlands continue to face the ticking clock and the warmed-up bulldozer. Local conservation commissions must be supported in their enforcement of the Wetlands Protection Act, and the Commonwealth must accelerate implementation of the Inland Wetlands Act. Those remaining communities without flood plain zoning must be encouraged to adopt — and uphold — this local protection measure.

It is important to keep in mind that Natural Valley Storage is one part of a three-part flood management program for the entire Charles River Watershed. A watershed is a single hydrologic system, and no activity takes place in one part of it without affecting the whole. Natural Valley Storage will prevent the increase in flood damages projected for the middle and upper Charles if the storage areas are developed. The new Charles River Dam under construction in Boston will alleviate flood damages in the lower watershed. The glue that will make those two stick will be the far-sighted decisions made in the local communities.

The people of the watershed should and must play an important and continuing role if Natural Valley Storage is to be a success. A Citizens Advisory Committee worked with the Corps and other state and Federal agencies during the study phase. Public meetings introduced the study recommendations to watershed residents. But the opportunity — the need — for public involvement does not end there.

During the coming year the Corps expects to conduct meetings and workshops in watershed communities to reinforce the public commitment to NVS and to answer any questions still unasked or unanswered. Further informational mailings will be made to keep the implementation status before the public. Between meetings and mailings, the Corps' NVS Project Manager is firmly attached to the other end of the phone (894-2400 extension 546). Indications of continued strong public support will encourage the Congress to make those annual appropriations to acquire the wetlands.

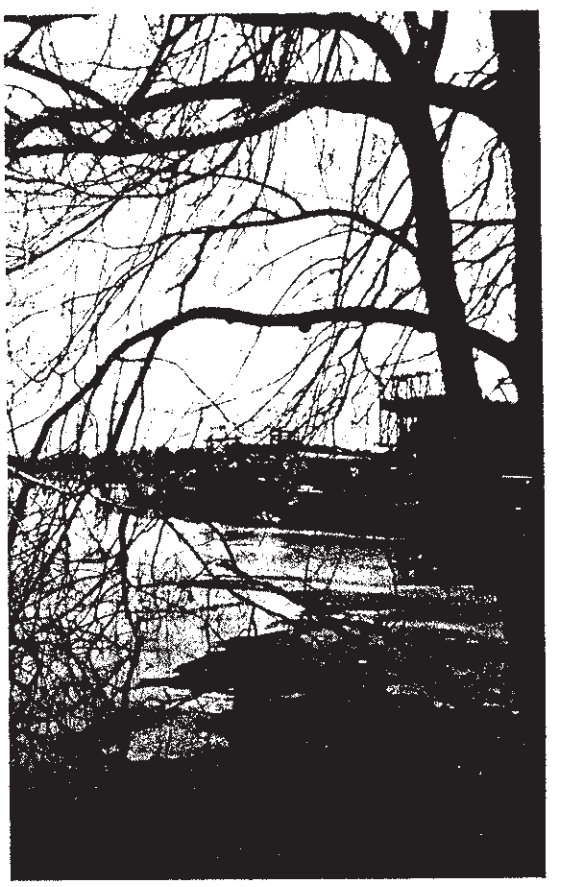
An exceptional opportunity for public involvement will be the determination of management policies for the NVS areas once they have been acquired. A management agency will have to be designated. The Corps will remain the sole owner of the acquired wetlands and will keep a sharp eye on them. However, the wetlands could become part of a national or state wildlife system for management purposes. Some of those that become part of the public domain may lend themselves to such minimal recreation uses as improved access to canoe launches, fishing grounds, and walking paths. They may be ideal for carefully-controlled nature study. In the final analysis, the NVS areas are flood control areas, and their management will be governed by their ability to support any use including no use at all. Where there are options, the public input will be solicited.

ANNUAL FLOOD LOSSES AS A FUNCTION WETLANDS LOSS

Condition	Annual Loss
Current — 1971	$158,000
With 10% loss of Storage	229,000
With 20% loss of Storage	414,000
With 30% loss of Storage	641,000
With 40% loss of Storage	957,000

Recurring Losses at Various Flood Stages 1970-2000
($1000 at 1970 Price Level)

Year/Stage	1970	1980	1990	2000
1968	400	500	620	820
1968+1	1,000	1,230	1,550	2,040
1968+2	2,000	2,450	3,100	4,070
1968+3	3,500	4,300	5,430	7,120
1968+4	6,000	7,350	9,310	12,210



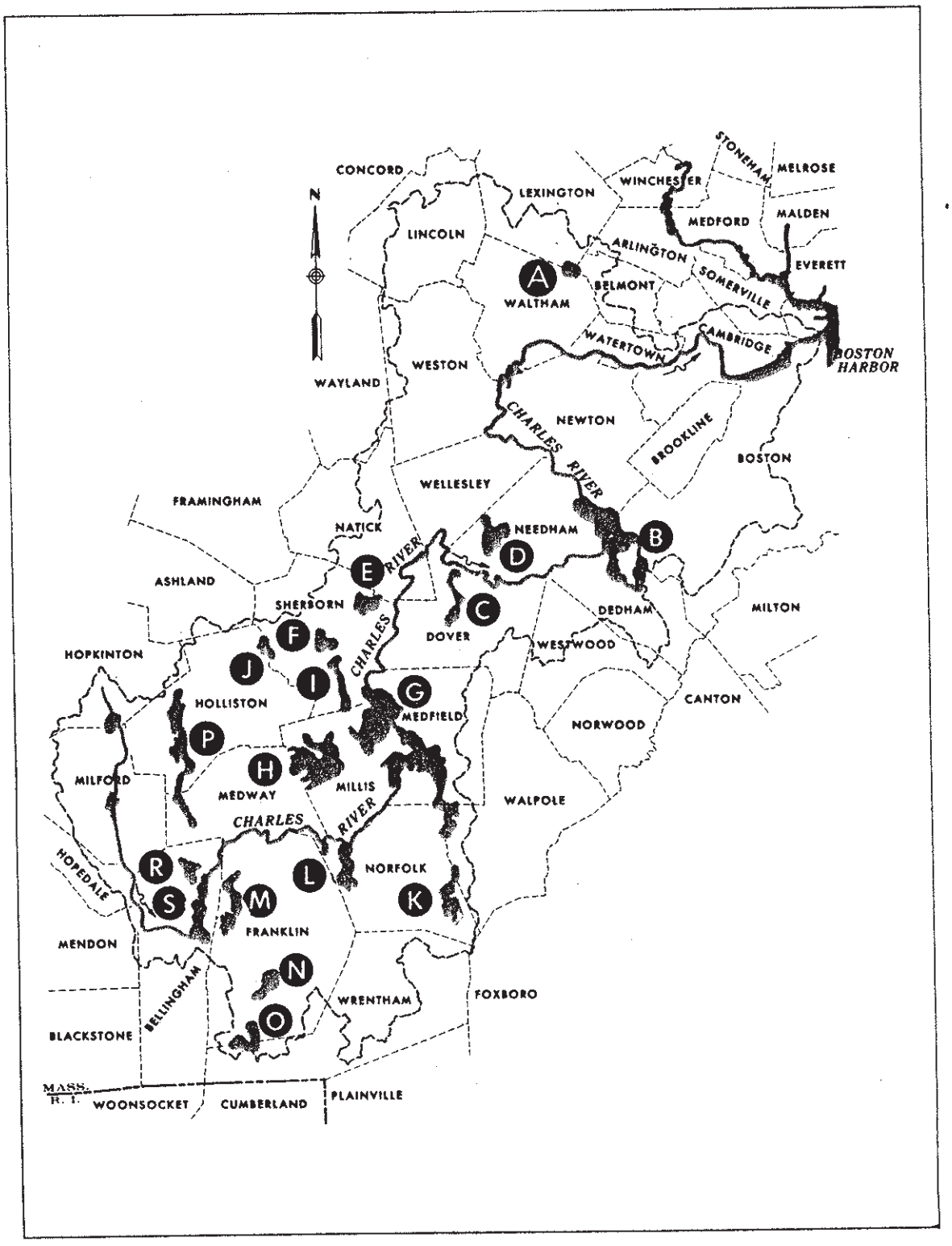
More than 400 of the estimated 8,500 acres designated for NVS belong to private land trusts such as Massachusetts Audubon Society and The Trustees of Reservations. While these lands carry certain restrictions, the Government will nevertheless acquire a permanent easement to insure permanent security of the land for flood management. Both organizations have been highly supportive of NVS. Similarly, it will be necessary that permanent rights be acquired in land owned by the Commonwealth of Massachusetts in order to insure perpetual security for flood management.

Local municipalities through their conservation commissions have engaged in land acquisition programs and some NVS parcels are under the jurisdiction of the commissions. While most of the wetlands have been acquired under state and Federal financial assistance programs and commission stewardship appears secure, nevertheless the Corps will approach them about acquisition.

A question asked while NVS was moving along its Washington approval route was whether the NVS objectives could be achieved by zoning. The Zoning Enabling Act (Massachusetts General Laws Chapter 40A section 2) permits the establishment of flood plain zones, and more than half the municipalities in the Charles River Watershed have adopted such zoning. Many have included wetlands as well in recognition of their role in public health, safety, and welfare. As in all instances of local zoning, however, the provisions are subject to appeal, and therefore the degree of security required for the NVS areas is not assured.

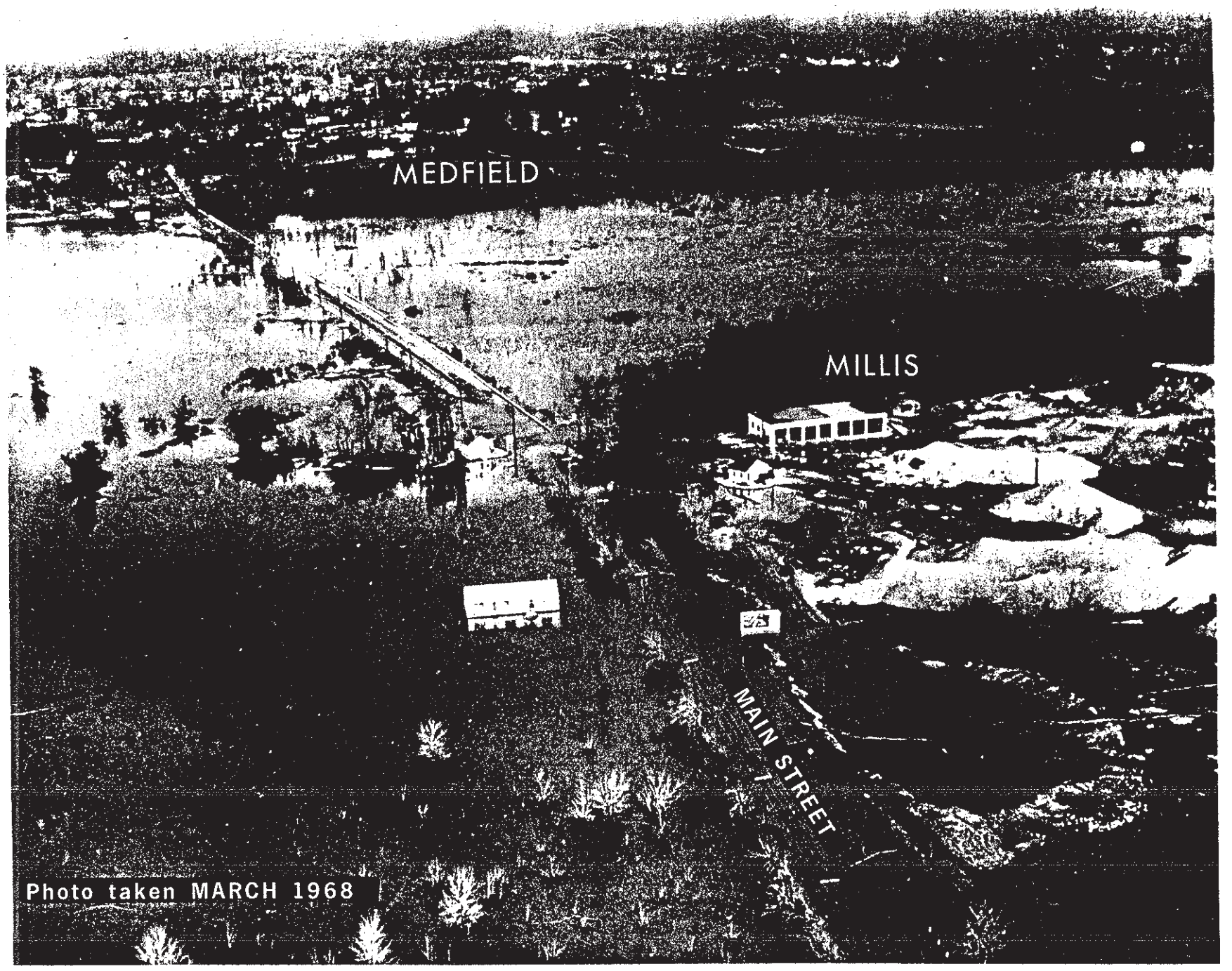
The Inland Wetlands Act (Massachusetts General Laws Chapter 131 section 40A) was passed in 1968 to restrict the development of major wetlands which were disappearing rapidly. The Charles was designated the target watershed for implementation. Nevertheless, the Commonwealth has initiated the program in very few communities, and half of those have rejected the restrictions which are presented to the municipality as a package. Noble in intent, the Act's performance has not been an outstanding success.

How will Natural Valley Storage affect the local economy? If loss of development land is the criterion, it will be relatively minor in some communities and decidedly significant in Millis where 23% of the town is now designated for NVS protection. Wetlands have long been attractive to developers, because they were cheap to buy and easy to fill. Controls imposed by the Wetlands Protection Act (Chapter 131 section 40) have increased the developers' cost of altering a wetland, but as yet there is no consistent valuation technique to indicate the true and total costs of a wetland being altered.



NATURAL VALLEY STORAGE AREAS

Designation	Stream	Acreage	Communities
A	Beaver Brook (reconsidered)		Belmont-Lexington-Waltham
B	Charles River	1,029	Boston-Dedham-Needham-Newton
C	Trout Brook	250	Dover
D	Fuller Brook	284	Needham
E	Indian Brook	234	Natick-Sherborn
F	Sewall Brook	118	Sherborn
G	Charles & Stop Rivers	2,340	Medfield-Millis-Norfolk-Sherborn-Walpole
H	Bogastow Brook	907	Medway-Millis
I	Tributary to Bogastow Brook	280	Sherborn
J	Dopping Brook	130	Holliston-Sherborn
K	Stop River	395	Norfolk
L	Mill River	360	Norfolk
M	Mine Brook	395	Franklin
N	Mine Brook	150	Franklin
O	Miscoe Brook	266	Franklin-Wrentham
P	Hopping Brook	704	Holliston-Medway
R	Stall Brook	180	Bellingham
S	Charles River	400	Bellingham



A segment of Area G (aerial)

The real estate aspects of Natural Valley Storage will assume a prominence unheard of in past flood management programs. As the hydrology information is being developed, work is in progress on identification and extent of ownerships. Thus, the work of the hydrologists measuring needed capacities and of the engineers determining wetland boundaries dovetails with the efforts of real estate personnel who are developing specific land requirements and cost estimates. Currently there are approximately 525 ownerships involved in the designated wetlands. The Corps now has a cartographer and appraiser working full time on the real estate planning phase of NVS.

Every title will be thoroughly searched since Corps ownership must be absolutely clear. Should the search disclose any clouded titles, the Corps will resort to condemnation if the defects encountered cannot be cured. The demand on appraiser talents generated by so many discrete ownerships will be heavy. Detailed appraisals of individual properties will be contracted out to qualified local independent appraisers and reviewed by Corps personnel. All owners will be approached individually for purchase negotiations. It may be necessary to institute eminent domain proceedings where negotiations for direct purchase fail because of disagreement of price or in the event that title defects prevent acquisition by direct purchase.

Outright purchase of all land rights is customary for federal flood control projects. However, since this is a non-structural program, the Corps recognizes that some landowners will prefer to retain title to their lands and convey a lesser interest which will satisfy NVS requirements. Inasmuch as all wetlands designated for NVS are in their natural state, no homes will be involved. While the goal of NVS is absolute protection, the approach to the program implementation has some flexibility. Fee acquisition is the policy for flood control programs, but there may be cases where a lesser interest will be acceptable. Where an owner is unwilling to sell his land, the Corps will attempt to negotiate a restrictive easement to retain the land in its natural state and preserve drainage characteristics. It will give the Government the right to "flow the land naturally" (let nature manage it) while the owner retains all other rights.

How does a Natural Valley Storage program take shape? Traditional flood control projects are authorized and funded in phases. The New England Division has prepared a Plan of Study complete with advanced engineering and design phases analogous to the traditional project development. The so-called construction phase, of course, will be land acquisition.

There is a difference between the Congress authorizing a project and appropriating the funds to pay for it. Each is a separate legislative action, and appropriations are an annual event. Essentially Congress will appropriate what the agency can spend on a project in any given fiscal period. Ideally appropriations and program implementation keep pace with one another. The cost of NVS has risen since the recommendation went to Washington to become a full-fledged program. The 1975 price tag is $11 million and land costs continue to rise, an added incentive to expeditious implementation.

The initial appropriation of $100,000 in fiscal 1975 was sufficient for the early stage of the work. The most critical element of that stage was aerial surveys. Aerial photographs for NVS had to be taken during a very brief period when the leaves were off the trees, the wetlands were not storing water, and hopefully a light dusting of snow was at hand. Nature and Congress were in harmony on this one, and just as the funds were approved in Washington, the trees became bare, the swamps were empty, and the flurries came by the mere handful. All areas including the stand-by Area A were flown. The Corps is employing orthomapping, a technique that corrects the distortions of normal aerial photography. The product is a clear and accurate map with all the contour lines and elevations needed by the engineers and the easy orientation to streets and structures so helpful to the lay viewer. Orthomapping permits a high degree of accuracy in defining the wetland boundaries, an important factor in the relationship between people and property.

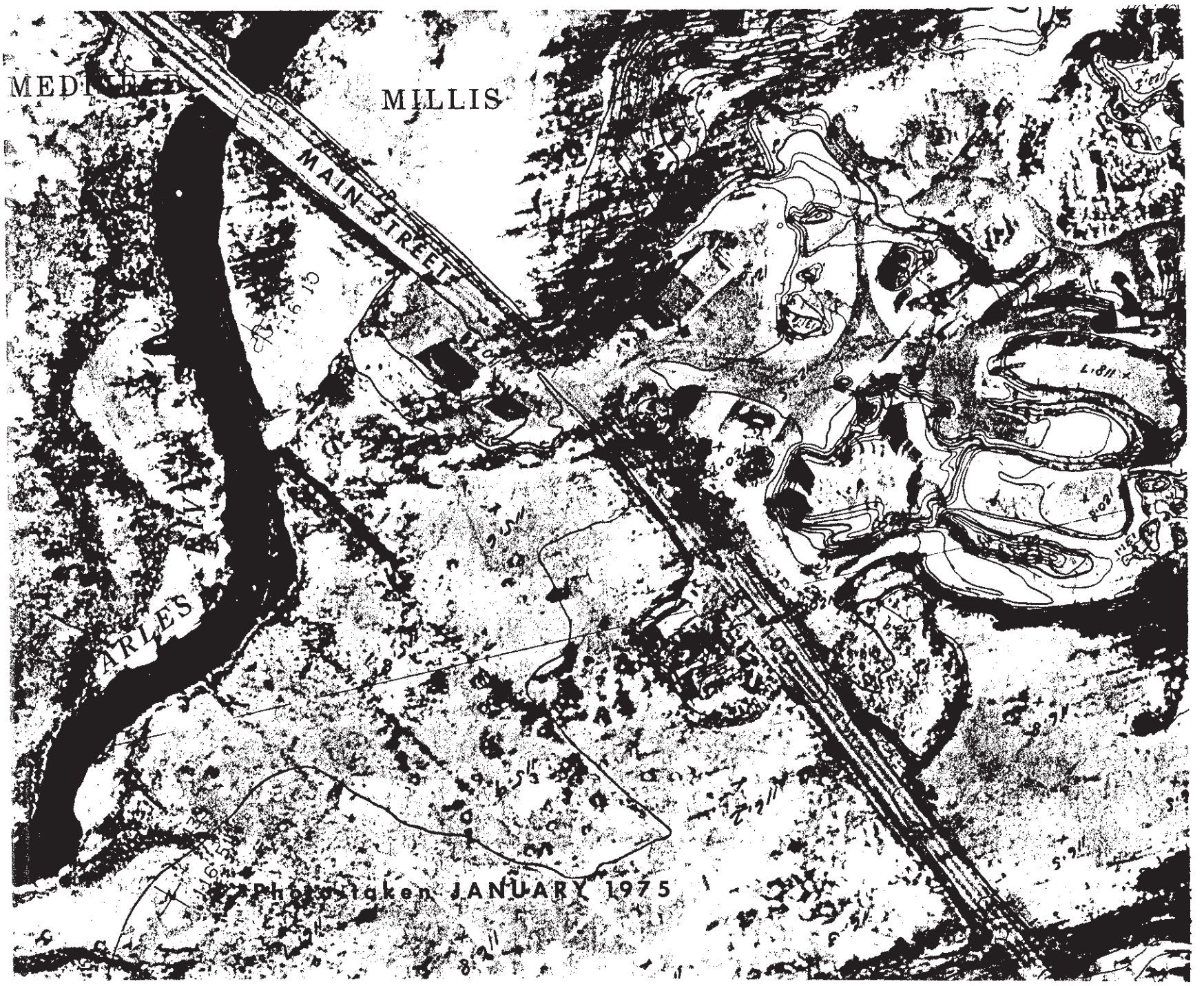
Another part of early implementation is recalculation of the wetland areas needed to achieve the objectives of NVS. Because the initial designations were preliminary and because some wetlands have been lost since 1971, the Corps must once again figure the volume of water that each wetland can retain and retard, how each relates to its fellow wetlands and to the parent river, and how many spoonfuls of storm water each can safely swallow. Measurements are being taken of both man-made (bridges, culverts, roads) and natural constrictions within and downstream of each NVS area. By mathematical modeling, the Corps will design and route project floods, and with additional field work will ascertain the effectiveness of the controls of individual and collective wetlands under various flood levels. The depth of the standard project flood in each NVS area will be determined. Calculations will be made of each area's proximity to the main stem and to the nearest damage center (Area B is the last major wetland storage area before the Charles River Watershed essentially turns into pavement). These hydrologic/hydraulic studies should be completed by the spring of 1976.

A requirement of the National Environmental Policy Act is the preparation of a formal statement on the environmental impact of every Federal project, giving consideration to all possible alternatives including no project. This represents an interesting prospect for the New England Division. Natural Valley Storage is itself an environmental statement. Structures are the obvious alternatives, or significantly increased flood damages without the project. The draft environmental impact statement was issued in 1972. The Corps expects to submit a final EIS in 1976, substantially unaltered.

In preparation now is the required General Design Memorandum, a blueprint for the project. It will contain the reaffirmation of the planning decisions contained in the Report on the Charles River and identify the coordinating roles of state and Federal interests in NVS. Based on data obtained from the orthomapping process and from the ongoing hydrologic/hydraulic studies, the Corps will establish the scope of the project to be carried out. Costs of NVS will be updated from the initial statement and a schedule of appropriations necessary to move the project forward will be set. No GDM would be complete without addressing the awesome prospect of no project. The blueprint is to be completed by summer 1976.

Naturally, many phases of the implementation work will continue from one fiscal year to the next, and annual appropriations will be sought to the extent that the Corps can accomplish the work in any given year. The allocation for the period July 1, 1975 to September 30, 1976 is $290,000. The jump to seven-digit requests will occur when the actual acquisition begins.

A segment of Area G (orthomap)



The Charles is a coastal plain river with a rather flat gradient. It rises only about 350 feet above sea level and drops 200 feet in its first 18 miles. However, in the next 20 miles between Medway and South Natick it drops only 40 feet, and in this reach are extensive wetlands. So the Corps came back to the incredibly efficient system already in effect, and attention was focused on the performance capabilities of major natural valley storage areas:

". . . . the fact that the Charles River Watershed has not yet had a serious flood problem is due to the modifying effect of swamps and marshes on high flows. These areas store waters that would create flooding and gradually release them without causing serious damage. The capacity of the valley storage in the Middle and Upper Charles has been hydrologically determined and prime sites for acquisition have been identified."

Recognizing this unique natural system was one thing. Insuring it was quite another. While there was still a somewhat rural character in much of the upper watershed, towns were feeling the pressures of expanding suburbanization from the core cities of Boston, Providence, and Worcester. To a great extent, the highway construction program was doing the planning for the local municipalities' growth. In the 1950s, Route 128 — the first belt highway around metropolitan Boston — attracted the aerospace industry, and what became known as Electronics Row short-circuited the Charles River. Towns to the west and south of Route 128 were still revising their statistics upward when a second circumferential highway belted the area 16 miles farther out (Route 495). The belts tightened on an already distressed watershed. The potential for economic development which they represented was exciting to the quiet towns, but before they could plan for orderly growth, the billboards began to pop up like mushrooms after a rainfall — and in the wetlands.

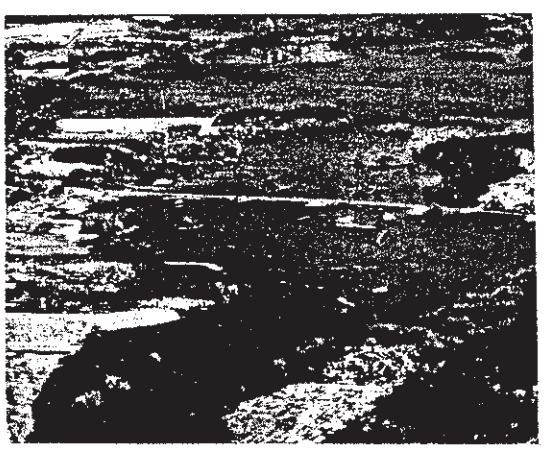
Faced with the prospect of imminent demolition of a finely-tuned flood control apparatus, the Corps put an URGENT stamp on the Natural Valley Storage plan. "In order to maintain the flood safety of the Charles River Watershed, immediate public acquisition of existing natural storage areas in fee or through easements should have first priority." The alternative would be dams and dikes, which the Corps had already decided did not suit this little river and which the residents clearly indicated did not suit them.

The watershed contains about 20,000 acres of wetlands. While many are small, all of them play a role in over-all watershed protection. Nevertheless, the Corps determined that acquiring every one of the 20,000 acres would be impracticable for a Federal agency. Several criteria were established for the selection of those wetlands to be included in the Natural Valley Storage program. To begin with the obvious, each wetland must be of sufficient size and capacity to store the volume of water it would be expected to handle. The wetlands must also be undeveloped, since it is their natural condition that makes them effective reservoirs. A third criterion is that they face imminent destruction from development. Without question the wetlands are there and are doing their job well. Since recent studies have indicated that the Commonwealth's wetlands are disappearing at a rate of 1% a year and the pressures are most intense in the Charles River Watershed, NVS was an obvious must.

A minimum of 100 acres was established as a qualifying requirement from the management aspect. Two areas initially considered were dropped when it was noted that development had reduced them in size below this criterion. However, Area A in the Beaver Brook sub-watershed in Belmont and Lexington is being reconsidered during implementation because of strong public pressure to restore it to the program.

Area G in summer

Area G in winter



Area G in spring flood

The smallest NVS area presently is Area F (118 acres) in Sherborn. The largest is Area G (2,340 acres) in Medfield, Millis, Norfolk, Sherborn and Walpole. Only three of the NVS areas are on the Charles River directly (B, G, and S). The others are in tributary watersheds where nature can sit firmly on the troublesome waters and keep them off the streets. The NVS wetlands are scattered throughout 16 municipalities in the middle and upper Charles. They are, the Corps says, inefficient in their transmission of flows from one to the other and to the river. This very inefficiency in passage of flows is the essence of the efficiency of the natural storage system as a whole.

While the effectiveness of NVS is accurately measured in hydrologic and hydraulic numbers, the drama of NVS is visible through a bird's-eye view of Area G through the changing seasons. By mid-summer the Charles has succumbed to the laziness of the season and pokes along quietly in its bed. In winter it nestles restfully under a blanket of ice and snow. As spring nears, however, the river stirs in its confines; as snows melt and rains fall, the Charles in the Millis-Medfield region stretches its normal 50-foot width to its full 1.5-mile flood potential. This is the norm, but just as floods can occur in any season in New England, NVS areas are standing by to do their thing all year round.

From time to time the question will arise from a mid-Charles community which has no NVS designations: what's in it for us? There is a simple answer: without the wetlands absorbing the storm upstream, the other mid-river residents would likely be sandbagging instead of sleeping peacefully through a storm. Because upstream flood flows are in no hurry to get to Boston, there is time for the Basin flood to be passed to sea so the pool may be cleared for the incoming waters. Were upstream flood waters deprived of their parking areas and forced to move on over the pavement, it is likely that the volume of water traveling at a greater speed would overwhelm the people downstream.

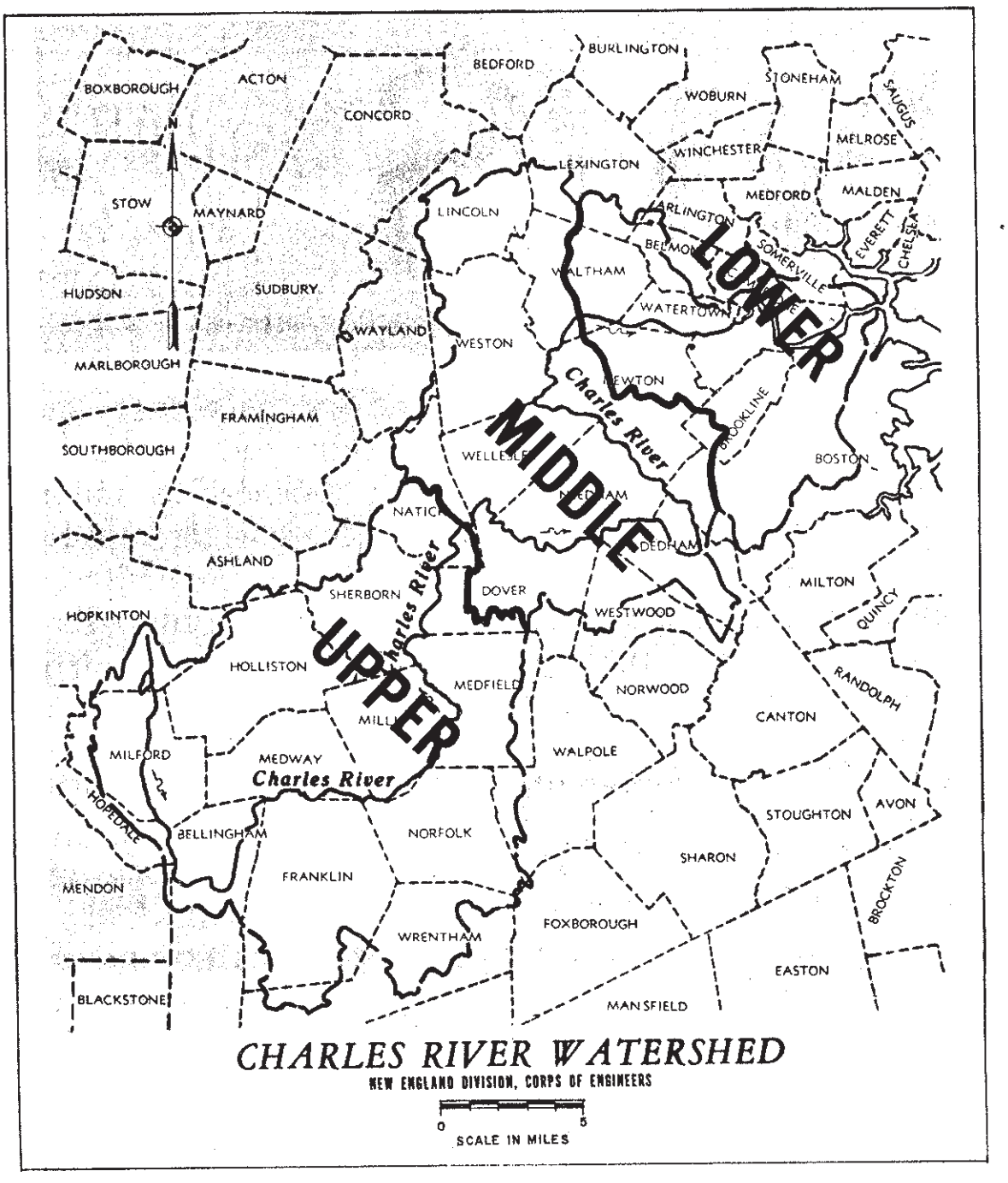
Natural Valley Storage was given an enthusiastic send-off to Washington. Throughout the conduct of the five-year study, the Corps worked with a Citizen Advisory Committee which adopted as a major function translating to the public at large the concept of non-structural flood control and its implications for other valley values. A series of informational meetings was organized by the CAC with the cooperation of local conservation commissions, and when the recommendation was made public in the watershed in 1971, there was unanimous endorsement. NVS won the nod of approval at the highest Corps level, but it encountered some Administration reluctance to extend the Federal flood control authority to such a large-scale land acquisition. Approval was withheld for almost a year, but NVS had other friends in Washington.

While the proposal was being processed through the Executive branch, legislation was introduced by Massachusetts Senator Edward M. Kennedy. Again the response was heartening. The idea of controlling floods without structures caught the interest of the Congress. Annual flood losses were mounting steadily across the country, and the Federal government was besieged with pleas for physical and fiscal bailing out. Surely the time had come to consider preventive measures. The Massachusetts delegation to Congress was fully committed to NVS, which readily found friends from other states as well. In due course, both houses of Congress included the Charles River Natural Valley Storage project in their water resources legislation. In October 1973, the Massachusetts House and Senate passed resolutions in support of NVS. Finally the word came from Washington that PL93-251, the Water Resources Development Act of 1974, contained the authorization for Natural Valley Storage at a price of $7.3 million. The vision of the Corps was entered into the law of the Congress.

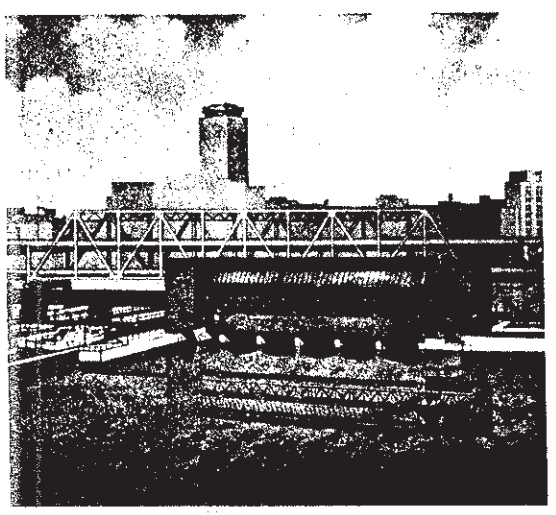
Put an hourglass on a map of eastern Massachusetts, tilt it slightly from southwest toward northeast, and the Charles River Watershed has been put in its place. The Charles River, the longest intrastate river in Massachusetts, meanders 80 miles across its 30-mile-long watershed from its uprising in Hopkinton to its ultimate disappearance into Boston Harbor. The river environment was shaped by many forces. Glacial activity defined the present 307-square-mile watershed, cutting off an earlier escape route to the sea at Narragansett Bay and rerouting the stream northeastward. Human activity brought 17th century development to the lower watershed and at once the mismanagement of the river began.

A 17th century map of the lower Charles shows a broad estuary, a thin neck of land, and a large bay. By the time the 18th century maps were drawn, the estuary had been narrowed and the neck considerably thickened. The 19th century maps record the disappearance of the bay under fill as the now-famed Back Bay section of Boston took shape. The 20th century maps show the impoundment of the lower 9 miles of river by the Charles River Dam and the filling of significant stretches of river frontage to accommodate the parkways that sandwich the Charles between Boston and Cambridge.

The Charles is not a giant among rivers but its flood message is not gentle for the two terminal cities of Boston and Cambridge. Both have displaced vast areas of tidal marsh that would normally buffer the high ground from storms. Flood damages in this portion of the watershed are extensive. Pavement and fill have overwhelmed pervious soils. Flood plains have been tidied up and walled in.



Former tidal marshes now support universities, high-rise office buildings, cultural institutions, and apartment complexes. Inevitably there is no place for storm water to go except over the pavement and into the river. The so-called Basin, the pool of water between the Charles River Dam and the Watertown Dam, has a controlled elevation. Too high a level means flooded roads, basements, and subway tunnels. Too low a level means loss of cooling water intake with resulting loss of power at Cambridge utilities, plus potential disruption of pleasure boat traffic. The Charles River flows to Boston Harbor through sluice gates (under the Science Museum garage) which depend on gravity for flow and therefore can only operate at low tide when the level in the Harbor is below the level in the Basin. Major storms tend to be accompanied by high tides and the impounded river waters back up. As part of the watershed flood management plan, the Corps proposed a new and more effective dam with pumps to pump storm water against the high tides. This new structure, now under construction about a half-mile downstream of the present dam, will be completed by late 1977, at which point the lock and sluice-way in the dam will remain open.



New Charles River Dam (architect's drawing)

Meanwhile, the Corps of Engineers made an interesting discovery: the Charles River is a hydrologic schizophrenic. Two distinct reactions to storms are activated by the river regimen and they operate independently of one another. It is clear that the unique characteristics of the upper watershed account for the marked difference in flood damages in the lower watershed.

Almost 10% of the Charles River Watershed is soggy. Swamps, marshes, and wet meadows abound in the middle and upper Charles (as they did downstream until they were "improved" into oblivion). Wetlands are still regarded by many as waste lands without inherent value. But these lands — supposedly sitting there doing nothing — do perform a valuable social function: unlike the arguments for filling them, wetlands do hold water.

The Corps overlooked nothing in planning its study. For purposes of on-the-job planning, a major storm hit the watershed in March 1968 while the study was in progress. Over a two-day period, 7 inches of rain coincided with snow melt. The storm offered a rare chance to test a developing theory in a real situation.

Flood records from previous storms showed extensive damages in the lower Charles but relatively minor damages in the middle and upper Charles. Clearly something sat on the flood upstream. Equally clearly there were no flood control dams. The 1968 flood crest moved so slowly that Corps personnel were literally able to measure the crest one day, go home for a night's sleep, and go back the next day to pick it up slightly below where they had left it. While the runoff from the 58 square miles of the urbanized lower watershed crested at the Dam in a matter of hours, the upstream crest was on a pokey four-day trip.

This performance was consistent with Hurricane Diane which created the flood of record in 1955. At the USGS gaging station at Charles River Village (river mile 34), 10% of the flood flow passed after two days and only 50% within the week. It was one month after her arrival that Diane finally packed up her remaining flood waters and took off to Boston. About 50,000 acre feet of storm water had been stored somewhere somehow for this delayed departure. And 50,000 acre feet is about the size of an average Corps flood control reservoir in New England. But where was the reservoir?

The 1955 story was repeated in 1968. But the Corps found the reservoir in 1968 — giant spongy wetlands sopping up the storm. Nature had already designed a miserly mechanism for storm-water handouts. The result was a gradual discharge from the wetlands into the stream, and it was the retarded flow that kept the residents safe and dry. A remarkable system was hard at work doing just what nature intended it to do.

During the study, all of the standard approaches to flood control were examined. It was clear from existing conditions that damages were not significant and that corrective measures were not called for. However, existing trends also indicated that future damages would be significant unless measures were undertaken to prevent the loss of wetlands and the accompanying increases in river stages. There was general agreement that any of the traditional structural approaches to a growing problem would be an affront to the lovely river and costs were out of proportion to the benefits. (The Corps estimated that to channelize a 10-mile stretch of river would cost $30 million, exclusive of social and environmental costs.)